

A Comparison of Two Low-Dimension Manifold Combustion Models for Nonpremixed Supersonic Combustion

Completed Technology Project (2015 - 2019)



Project Introduction

The capability of accurately simulating supersonic combustion is a vital topic for designing and advancing hypersonic air-breathing vehicles. As a consequence, there is high demand for accurate, versatile, and computationally cost-effective supersonic combustion models. Additionally, there is a lack of quantitative comparative studies on Large Eddy Simulation (LES) combustion models. A research investigation to conduct a quantitative comparative study of prominent LES turbulent combustion models for supersonic combustion is proposed herein. The three turbulent combustion methodologies that will be investigated are the Flamelet model, the Filtered Mass Density Function (FMDF) model, and the Linear Eddy Mixing (LEM) model. To assess these three methodologies, three validation experiments involving supersonic combustion will be simulated. This study aims to find the accuracy, versatility, and the computational cost of each of the investigated LES combustion models. Furthermore, the deficiencies and shortcomings of each of the models will be identified. The outcome of this research investigation will directly benefit NASA's launch propulsion system research objectives. High priority research areas, such as Turbine Based Combined Cycle (TBCC) and Rocket Based Combined Cycle (RBCC), can benefit from high fidelity simulation tools.

Anticipated Benefits

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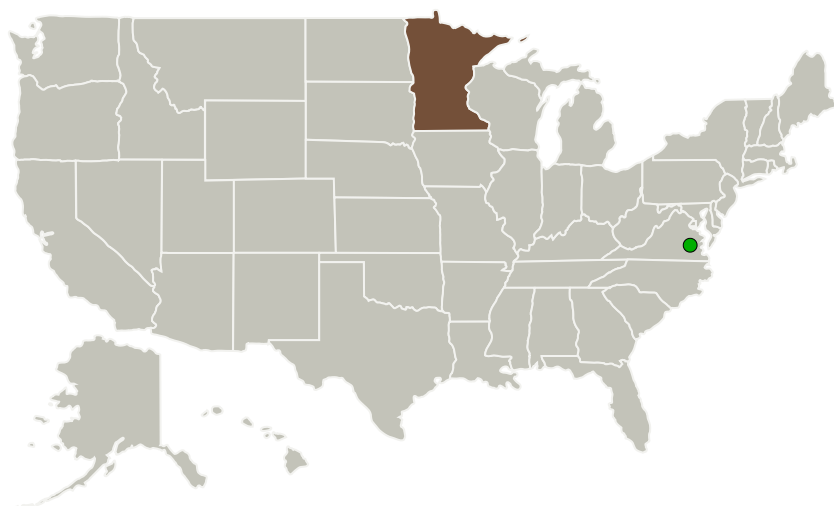
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Minnesota-Twin Cities	Lead Organization	Academia Asian American Native American Pacific Islander (AANAPIST)	Minneapolis, Minnesota
● Langley Research Center (LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

Minnesota

Project Website:

<https://www.nasa.gov/strg#.VQb6T0jJzyE>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Minnesota-Twin Cities

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Graham V Candler

Co-Investigator:

Honest F Mrema

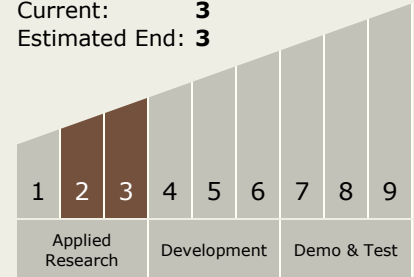
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Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.3 Aero Propulsion
 - └ TX01.3.4 Pressure Gain Combustion

Target Destination

Outside the Solar System